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Soil Survey

of

Cass County, Texas

By

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and

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Bureau of Chemistry and Soils

In cooperation with the
Texas Agricultural Experiment Station

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SOIL SURVEY OF CASS COUNTY, TEXAS

By M. W. BECK, in Charge, and HOWARD WILLIAM HIGBEE, United States Department of Agriculture, and R. M. MARSHALL, Texas Agricultural Experiment Station

INTRODUCTION

Cass County, comprising an area of 951 square miles in the extreme northeastern part of Texas, occupies a typical section of the timbered sandy Gulf Coastal Plain. It is characterized by moderately well distributed rainfall, moderate annual temperatures, long warm summers, and short cool winters. The climatic conditions are favorable to a diversified type of agriculture. Cotton growing is the principal pursuit, and about 70 percent of the crop land is devoted to cotton. Corn, the crop second in importance, occupies about one-third as much land as cotton. Miscellaneous feed crops are also important. The subsidiary farm activities are concerned chiefly with small-scale production of food products for home and local use. Small acreages are in fruits, vegetables, and pastures.

The relief is that of an intricately and deeply cut plain, and the land ranges from gently rolling to very rolling. The major valleys are deep, the bordering lands are steeply sloping, some of them hilly, and the divides are narrow undulating ridges. The plain is underlain by very deep beds of unconsolidated sands and claypan sandy clays, representing old water-laid Tertiary deposits hundreds of feet thick. The beds contain strata of heavy clay in places, and in some areas sandstone layers. Considerable bodies of land have ferruginous sandstone fragments scattered over the surface.

This county lies within the belt of yellow, leached, sandy soils, which occurs as a southern and eastern coastal strip along the Atlantic Ocean and the Gulf of Mexico and extends southward into Mexico. However, that part of the belt characterized by the geographic features predominating in Cass County reaches only part way across the southeastern part of Texas. This belt, known in Texas as the east-Texas timber country, was originally and still is largely occupied by a heavy growth of timber consisting of pines associated with some hardwood, chiefly several species of oak. Probably a little more than one-third of the original forest land has been cleared for use as farm land.

Most of the soils are very light in color. The soils of the uplands and terraces are sandy in texture in the upper layers, but the subsoils, in general, are heavier than the topsoils and also differ materially from each other. It is mainly on differences in characteristics of the subsoils that the classification and correlation of the soil series are based. The upland soils have, for the most part, good surface drainage, and the subsoils and substrata of most of these soils are sufficiently permeable to afford moderately free underdrainage. Only

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small spots of upland soils have very poor drainage and dry out slowly after a heavy rain. Practically all the soils developed from alluvium, which comprise nearly one-sixth of the total area of the county, are very low and flat, with poor or moderately good drainage.

The principal upland soils are those of the Ruston, Bowie, Caddo, Orangeburg, Kirvin, and Nacogdoches series. They are thoroughly leached of their basic mineral constituents, and they contain a very small amount of organic matter. They are therefore very deficient in nitrogen. The results of studies and analyses of these soils indicate that they are also very deficient in phosphorus. They are all well drained except the Caddo soil. All are very light in color, except the Nacogdoches soil, which is red or reddish brown. Those upland soils which have dense subsoils and very slow underdrainage are included in the Susquehanna, Lufkin, and Leaf series. The upland soils are the products of the soil development of a highly siliceous parent material under conditions of high rainfall and a timber vegetation, which have allowed rapid erosion and leaching.

Small areas of fairly smooth but well-drained soils occur on high old stream terraces. These are soils of the Cahaba and Kalmia series. The Leaf soils are flat and poorly drained. The smoother soils are less subject to erosion, and the Leaf soils have heavier subsoils which prevent excessively deep leaching.

The soils of the bottom lands are the Bibb, Ochlockonee, and Johnston. These soils are of potential high productiveness, but under present drainage conditions are, for the most part, too wet for use by cultivated crops and therefore remain almost entirely in forest.

The dominance of cotton in the agriculture may be assigned, not only to the natural response of the crop to the climate and the soils, but to its value as a cash crop—one that may be easily marketed at any season. Practically all the soils are utilized for the same crops, and similar methods of cultivation are used. Differences in yields, on different soils, of cotton and corn are the result of seasonal conditions, differences in fertilization, and methods of farm management as much as differences in the character of the individual soils. On many soils, yields have been sustained largely by the use of commercial fertilizers, although some farmers practice the natural methods of soil improvement by growing legumes, such as peas, and by plowing under organic matter. In recent years many farms have been terraced to reduce soil erosion. Although many of the soils are well suited to the production of fruits and vegetables, commercial production of these crops receives very little attention, and the small acreage devoted to them is sufficient only to satisfy home and local requirements. The livestock on most farms includes a few work animals, milk cows, and hogs. The production of milk and meat on most farms does not exceed local requirements, but on some farms a little milk and some poultry products are sold for shipment to outside markets.

COUNTY SURVEYED

Cass County lies in the extreme northeastern part of Texas (fig. 1), about 20 miles south of the northern boundary of the State.

On the east it borders the southwestern and northwestern corners of Arkansas and Louisiana, respectively. Linden, the county seat, situated in the south-central part of the county, is about 35 miles southwest of Texarkana and 50 miles northwest of Shreveport, La. The total area of the county is 951 square miles, or 608,640 acres.

Physiographically, Cass County is an old sandy plain dissected by many stream valleys. The less deeply dissected parts comprise gently rolling areas. In the more deeply dissected areas, the smoother land is confined mainly to narrow rolling ridges—the drainage divides. Elevations range from about 200 feet in the southeastern part of the county to about 600 feet in the northwestern part, indicating that the general slope is coastward from northwest to southeast. Approximate elevations above sea level are as follows: Atlanta 260 feet, Douglassville 300 feet, Linden 400 feet, and Hughes Springs 400 feet.

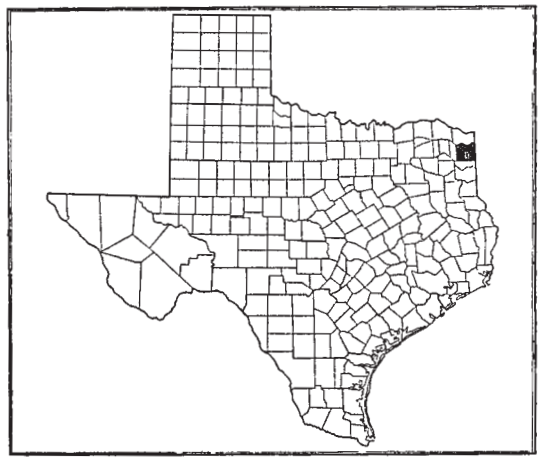

FIGURE 1.—Sketch map showing location of Cass County, Tex.

The relief is conspicuously featured by a very rolling surface—the result of erosion. Deep valleys have been cut by the major streams. Numerous tributaries, which start as gullies in the higher lands, reach most sections of the county, and along them are many small short shallow valleys. The larger valleys are occupied by flat strips of bottom land, ranging from one-half mile to 2 miles in width, through which the sluggish-flowing streams follow tortuous channels. The channels are but slightly lower than the bordering very poorly drained land. Several small stony hills in the southwestern part rise to a height of more than 200 feet above the surrounding country and are locally termed mountains. The largest are Cusseta Mountains about 5 miles east of Marietta, and Hall and Donaldson Mountains about 7 miles east of Hughes Springs. These hills have been protected from erosion by the large amount of ironstone material capping them. The smoother uplands, which occupy the broader drainage divides, and the old stream terraces, are undulating or gently rolling. The gradient of most of the slopes does not exceed 6 percent. On the smoother benches a billowy relief is caused by low moundlike areas. Between the mounds are slight depressions which have no surface drainage, but underdrainage is sufficient to enable them to dry out during warm dry weather.

Nearly all parts of the county are thoroughly drained by the dendritic arrangement of the streams which penetrate almost every section. All drainage is into Red River, which flows southward some

15 or 20 miles east of the county. The largest stream in the county is Sulphur River, which flows in an easterly direction and forms the north boundary. It receives drainage from an irregular bordering strip of land from 3 to 10 miles wide. The rest of the county is drained by large creeks which originate locally and flow southeastward into Cypress Creek in Marion County, thence into Red River. Most of the streams flow only during the cooler seasons of the year. The uplands in general drain rapidly and, owing to the high rainfall, erosion is severe. Lateral subsurface leaching is rapid on account of the steep slopes of the bordering valley lands. The bottom lands remain wet and saturated much of the time. They dry out thoroughly only during the hot summer season.

Cass County originally was covered with a dense forest, much of which still remains. The present growth consists mainly of mixed shortleaf pine and hardwoods. In places pine is dominant, although a great many of the larger pines have been cut for timber. The hardwood growth consists mostly of several species of oak, principally red, post, blackjack, white, and sand jack. There are a good many sweetgum and some hickory. In the bottom lands the trees are mainly water, willow, and bur oaks, and some gum, elm, cypress, and other trees grow, a small proportion of them being pines. The tree growth is vigorous and dense, and many trees attain large size. The predilection of certain species of trees to particular conditions of soil and moisture has given rise to the distribution of tree growth in somewhat direct relation to these features. In general the wet lowlands have a larger proportion of water and willow oaks, the stony and moderately deep sandy soils a rather large proportion of blackjack oak, and the deep fine sands a typical growth of sand jack oak which grows on no other kind of soil. As a rule the smoother upland soils of comparatively high productivenss support a rather large proportion of red oak. Underbrush is abundant and includes various shrubs and herbaceous plants, chiefly dogwood, poison-oak, and French mulberry. Very little grass grows in the heavily forested areas, but where the tree growth is thin, coarse bunch grasses, mainly broomsedge, grow. In some of the less wet bottom lands, carpet grass predominates.

The county is well supplied with underground water of good quality, which is easily obtainable from shallow wells for farm and home use.

Local reports state that the first permanent white settlements in this county were made in the vicinities of Atlanta, Linden, and Hughes Springs between 1835 and 1840. Settlement at first was slow, but pioneers gradually came in from the older Southern States, made small clearings, and engaged in farming. In 1846 Cass County was organized, and in 1852 the present boundaries were outlined and established. In 1930 the population was 30,030, all classed as rural, and the density was 31.6 persons a square mile. Nearly all the people are native born, and about one-third are Negroes. The population is somewhat more dense near towns and improved highways. Atlanta, the largest town, has a population of 1,685, and Linden, the county seat, 718. Smaller towns are Hughes Springs, Bloomburg,

Queen City, and Douglassville, and villages are located throughout the county. Agriculture is practically the only occupation.

Several railroads provide good transportation facilities. These are the Texas & Pacific, Kansas City Southern, St. Louis Southwestern, Jefferson & Northwestern, and Louisiana, Arkansas & Texas. A paved highway extends across the county from north to south, one crosses the northeastern part connecting Texarkana and Shreveport with the principal towns, and two cross the northwestern part. A network of roads reaches all sections, but all except the ones mentioned are dirt roads, the more important of which are maintained in good condition. Many of the less important ones become rough and difficult to travel during wet seasons. The rural sections are well served with rural free delivery of mail. Schools and churches are situated conveniently throughout all parts.

CLIMATE

The climate of Cass County is healthful and mild. The winters are short and cool, and now and then during periods of several days' duration light freezes occur. Such cold spells are the results of the northers which in this section of the State are less severe and occur less suddenly than they do farther west. As a rule the winters are rather wet. Some sleet and snow falls occasionally, but periods of freezing and icy weather are of short duration, rarely lasting more than 4 or 5 days. Between the cold spells the weather is cool and pleasant. The summers are characterized by rather high temperatures which are moderated somewhat by the Gulf breezes. The average length of the frost-free season is 232 days, from March 21 to November 8.

The average annual precipitation of 43.63 inches is well distributed throughout the year, the largest amount occurring during the spring and the least during the fall. Occasionally excessive rainfall damages some crops and causes overflows in the lowlands. At times extended periods of dry weather in the summer are sufficiently long to injure crops, especially corn.

The long frost-free season and ample rainfall favor the production of many different crops and the raising of livestock. The mild temperature and comparative freedom from late frosts favor the production of early vegetables and fruits. Occasional late frosts, however, cause losses of fruit crops, and possibly such losses are partly responsible for the lack of extension of fruit growing on a commercial scale.

Table 1, compiled from records of the Weather Bureau station at Texarkana, which is situated about 15 miles north of the northeastern corner of the county, gives detailed data fairly representative of climatic conditions in Cass County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Texarkana, Bowie County, Tex.*

[Elevation, 332 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1893)	Total amount for the wettest year (1905)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	46.8	82	2	3.75	0.65	6.87
January	46.0	85	−7	3.65	.62	3.84
February	48.4	88	4	3.12	.07	3.53
Winter	47.1	88	−7	10.52	1.34	14.24
March	56.5	92	21	4.23	2.17	5.95
April	64.2	94	26	5.04	4.33	4.46
May	71.6	100	35	4.47	5.97	12.71
Spring	64.1	100	21	13.74	12.47	23.12
June	79.2	106	51	3.56	5.21	12.24
July	82.4	108	52	3.42	2.30	9.92
August	82.2	109	50	3.07	1.88	3.64
Summer	81.3	109	50	10.05	9.39	25.80
September	76.8	108	39	2.91	1.93	5.22
October	65.8	97	20	3.13	1.03	3.53
November	55.2	88	15	3.28	2.24	4.82
Fall	65.9	108	15	9.32	5.20	13.57
Year	64.6	109	−7	43.63	28.40	76.73

AGRICULTURE

Agriculture began to develop at the time of the first settlement of the county. The first efforts were the simple cultivation of the few acres cleared from the forest which surrounded the homesteads of the pioneers. Long before the Civil War, small homesteads were cleared and farmed in various sections, principally on the smoother upland areas. The first crops were grown mainly for subsistence and included principally corn, vegetables, and potatoes. Small acreages were soon planted to cotton and oats. With the advent of steamboat transportation from Jefferson, Harrison County, an impetus was given to the production of cotton, and Jefferson became the principal market for this product. A gradual increase in the number of settlers and the clearing of the forests for small farms continued throughout various parts of the smoother lands, and cotton, corn, oats, and vegetables were the chief products. The advent of railroads across the county in the early seventies gave a stimulus to settlement and to the "opening up" of land for farming. Settlement was doubtless facilitated by the introduction of the lumber industry about that time, when sawmills began to convert the shortleaf pine timber into lumber which was shipped out. Only the smoother better drained upland areas were cultivated, and practically none of the bottom land was farmed, as the alluvial soils have always been too wet for cultivation.

Since the census of 1880 development of agriculture in this county can be more definitely summarized. In 1880, 54.6 percent of the

total land area was in farms, but of this only about one-fourth was improved farm land. Although farms gradually decreased in size from 187 acres in 1880 to 82.7 acres in 1935, the number increased, and at the latter date about 38 percent of the total land area of the county was available for the production of farm crops.

Cotton and corn have always been the principal crops, but a small acreage is devoted to feed crops for the farm livestock, and vegetables and other food crops are grown for home use. Cotton and corn occupied about equal acreages until after 1910, when the amount of land devoted to cotton showed a decided increase and the acreage in corn decreased. Truck and vegetable crops, such as peas, potatoes, sweetpotatoes, tomatoes, and peanuts, have been grown at various times in the attempt to develop commercial production of crops other than cotton and corn. The development of commercial production of vegetables and fruits has not obtained a firm foothold here, and practically all the farmers have continued to grow cotton as the chief crop. This has been encouraged largely by the comparatively high prices received for cotton during the several years following the World War. Most of the soils are well suited to fruits, vegetables, many truck crops, and berries, and also to the development of pastures which encourages the raising of livestock and dairying. The high price of cotton within recent years, however, has caused the chief interest to be centered about this crop, and corn has become a local feed product. These crops do fairly well, but the soils, which are only moderately productive, require the use of commercial fertilizers in order to produce good yields. The highly specialized production of cotton as a cash crop on soils requiring expensive rejuvenation with commercial fertilizers is illustrated forcefully by the fact that more than one-third of a million dollars, representing an outlay of $84.64 a farm, was spent for commercial fertilizers in this county in 1929. Since 1930 the prices paid for cotton have declined, and the use of commercial fertilizer has been greatly reduced.

Table 2, compiled from census reports, gives data relating to farms and farm operators in this county at stated periods.

TABLE 2.—*Farm data for Cass County, Tex., as reported by the Federal census*

Year	Population	Farms	Average size of farms	Average improved land per farm	Average assessed value of land per acre	Farms operated by—			Expenditure for fertilizer
						Owners	Tenants	Managers	
		Number	*Acres*	*Acres*	*Dollars*	*Per cent*	*Per cent*	*Per cent*	*Dollars*
1880	16,724	1,778	187.0	49.8	----------	76.4	23.6	--------	495
1890	22,554	2,486	132.0	49.3	----------	64.4	35.6	--------	1,451
1900	22,841	3,271	112.6	50.3	3.22	61.6	38.3	0.1	2,380
1910	27,587	4,466	89.1	41.6	7.37	54.2	45.7	.1	23,961
1920	30,041	5,355	80.2	44.5	23.47	49.4	50.5	.1	85,115
1930	30,030	5,841	67.8	41.7	22.94	39.4	60.5	.1	351,795
1935	(1)	5,504	82.7	38.1	14.91	43.5	56.4	.1	(1)

[1] Not reported.

According to the census of 1935, 74.8 percent of the total land area is in farms. In 1934 the crop land harvested was 151,688 acres, or 24.9 percent of the total land area. Of this, 68,576 acres were in cotton and 56,197 acres in corn, most of which was grown for grain.

Cotton and corn, together, occupied about 82.3 percent of the total crop land harvested. The rest of the crop land is used for the production of miscellaneous feed and food crops grown for home and local use. The same census reports 10,895 acres in hay and sorghums for forage, of which 8,040 acres were in legumes, 1,800 acres in sorgo and grain sorghums, 178 acres in small grains cut for hay, and 877 acres in tame and wild grasses. There were 404 acres in sugarcane, 938 acres in potatoes, and 1,736 acres in sweetpotatoes. Most of the farms, in addition to a small home garden, in which many different vegetables are produced, have small orchards devoted to fruits, as apples, peaches, pears, plums, and grapes. A few planted pecan groves are on the farms.

The livestock on the average farm includes the necessary work animals, a few milk cows, and sufficient swine and chickens to provide the home with these food products. On January 1, 1935, there were in the county 23,174 cattle, 10,007 swine, 1,719 horses, 6,607 mules, and 61 sheep. Large flocks of poultry, mainly chickens, are raised.

The agriculture is carried out on small farms operated chiefly for the purpose of producing cotton as a cash crop with the rest of the farm operations designed to produce the feed and food necessary for the subsistence of the livestock and the farmer's family. Some farmers sell their surplus of pork, dairy, and chicken products in the local markets, and, on the other hand, some produce insufficient of these for their own use. Since 1929, with the lowered price of cotton and other farm products, much more attention has been given to subsistence farming, wherein greater effort has been given to producing sufficient feed and food products.

The total value of all crops and agricultural products produced in 1929 was $6,230,431. Of this amount $474,438 represented the value of cereals (mostly corn), and vegetables, including potatoes and sweetpotatoes were valued at $134,276. Miscellaneous field crops (mainly cotton) were valued at $3,891,195. The value of domestic animals on the farms on April 1 totaled $1,173,463, and of butter, cream, and whole milk sold, $57,574. The value of poultry raised on the farms in 1929 was $164,783. The value of chicken eggs produced was $204,331, of which $62,052 worth were sold. Chickens sold that year brought in $41,005. The chief truck products sold from the farms were as follows: Watermelons, with a value of $24,846, snap beans valued at $3,307, and cantaloups at $1,238.

In 1929 $351,795 was spent for fertilizer on 4,156 farms. Fertilizers, most of which are bought ready mixed, are used almost entirely for cotton and corn. The formula in most common use is 4–8–4.[1] Some mixtures contain as much as 12 percent phosphoric acid. Some farmers mix their own fertilizers and use various proportions of cottonseed meal, superphosphate, nitrate compounds, and other ingredients. The soils respond readily to commercial fertilizers, to the growing of legumes, and to the incorporation of organic matter and manure. Many farmers, however, do not use, to a great extent, the practical means of soil improvement. Some increase the productiveness of their soils by growing cowpeas and by plowing under vegetable matter to increase the organic content of the soil.

[1] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

Owing to the small size of the farms, the farm family generally furnishes sufficient labor for the necessary work. Some extra labor (largely colored) is employed. Wages range from 75 cents to $1 a day or from $15 to $20 a month, in addition to a house.

Nearly one-half of the farms are between 20 and 50 acres in size, and nearly one-half range from 50 to 175 acres. About 500 are smaller than 20 acres.

A large proportion of the farms are operated by tenants, and there has been a gradual increase in the proportion of tenancy since 1880. The prevailing system of rental is on shares, whereby the owner receives a part of the crops. In 1930 there were 2,060 white and 1,472 colored tenants, and less than 100 paid a cash rental. Nearly 1,300 of the tenants were classed as croppers who usually furnish only the labor, and the landlords furnish the land and equipment, in return for which they receive one-half of the crop as rental. Most of the tenants furnish labor, work animals, and equipment, and pay the landlord one-third of the corn and one-fourth of the cotton as rental.

Many of the farm homes are substantial and comfortable, but the outbuildings are in general unpretentious and rudely built. They include small barns, sheds, and outhouses. Many of the tenant homes are of very simple construction. They are small unpainted frame buildings, and there are few outbuildings except small sheds and stables. According to the 1935 census the average value of land and buildings a farm is $1,233. The farm machinery is of a very simple and inexpensive type. The implements on most farms are one-horse plows, harrows, cultivators, and planters. The work animals are small medium-weight mules and horses. The cattle include a few head of milk cows, mainly grade Jerseys. The swine are chiefly of Poland China and Duroc-Jersey breeds and grades of these.

The farm crops are produced by the simple methods of cultivation which prevail largely throughout the sandy coastal plain of the South. The land is prepared mostly by bedding, and the fertilizer is applied in narrow low ridges on which cotton and corn are planted. Little attention is given to systematic crop rotation, and many farmers make little attempt to improve the soil by plowing under organic matter. Some practice the growing of cowpeas in the cornfields, sometimes in alternate rows, as this has proved satisfactory on many farms by adding nitrogen to the soil and making a vine crop furnishing valuable hay. In recent years much attention has been given to terracing, in order to prevent severe washing of the land.

The lack of a systematic rotation is probably due to the fact that cotton is the only dependable cash crop, and the comparatively high price of cotton since the World War has encouraged the production of this crop to a great degree. Cotton is grown on practically every farm and receives the most attention in the agricultural operations. Through the use of commercial fertilizers, yields are moderately high, and in 1929 an average of three-tenths of a bale an acre was made, although this required considerable outlay for fertilizer. Short-staple cotton is grown. Mebane is the leading variety, and considerable Half-and-Half, a very short staple cotton, has long been grown by many farmers. It is reported that Acala has become an important variety in some sections. Experiments made at the

Nacogdoches substation on soils similar to the principal agricultural soils of this county, indicate that Acala, Truitt, New Boykin, Lone Star, and Rowden may be considered the most satisfactory varieties to grow on these soils.[2]

The customary application of commercial fertilizer for cotton is from 200 to 300 pounds an acre of a 4–8–4 mixture. Results of experiments on Kirvin and Nacogdoches fine sandy loams at Troup and Nacogdoches indicate that these and similar sandy soils in the eastern part of the State are deficient in nitrogen, phosphorus, and potash, and that applications ranging from 200 to 400 pounds of a 4–6–4 or 4–8–4 fertilizer, or one supplying similar ratios and quantities of plant nutrients, are recommended for cotton on these soils.[3]

The land for corn is prepared and fertilized in much the same way as that for cotton. The soils are not highly suited to corn, however, as they are deficient in organic matter as well as low in the plant nutrients already mentioned. Frequently, short summer droughts occur at the critical period of growth, causing a reduction in yields. Strawberry Dent and other varieties are grown. According to results obtained in experimental work in some east Texas substations, the varieties recommended for this section of the State are Surcropper, Chisholm, Ferguson Yellow Dent, and, for early planting, Davis Prolific.[4]

SOILS AND CROPS

The soils of Cass County are representative of soil conditions throughout a large section of eastern Texas and other Southern States within the Gulf Coastal Plain. In Texas this is known as the east-Texas timber country. In general it is a rolling sandy area occupied by a heavy timber growth.

The soils may be divided into two broad groups on the basis of their general suitability for producing farm crops. These are (1) the rolling sandy timbered upland soils which, when cleared, may be used for farming; and (2) the bottom-land soils which comprise about 15 percent of the county. Though of potential high productiveness, the latter soils have such poor drainage that, with the exception of a few comparatively small areas, they cannot be used for farm crops. The upland soils originally supported a timber growth of mixed pine and oak, much of which still remains. All these soils have a top layer of fine sand containing very little silt or clay, and they are light textured and only slightly coherent. Owing to the prevailingly high rainfall, these soils have been subjected to rather excessive leaching, and they contain a comparatively small quantity of the more valuable plant nutrients and are limited in productive capacity because of their very small content of organic matter. The topsoils differ in thickness in various locations and for the most part are underlain by subsoils that contain clay. The subsoils differ from place to place in color, texture, and structure. On the basis of the subsoil differences, which are to some extent indicative of the crop

[2] MORRIS, H. F., and MCNESS, G. T. VARIETIES OF COTTON FOR CENTRAL EAST TEXAS. Tex. Agr. Expt. Sta. Bull. 384, 36 pp., illus. 1928.

[3] REYNOLDS, E. B., and others. FERTILIZER EXPERIMENTS WITH COTTON. Tex. Agr. Expt. Sta. Bull. 469, 31 pp. 1932.

[4] MANGELSDORF, P. C. CORN VARIETIES IN TEXAS: THEIR REGIONAL AND SEASONAL ADAPTATION. Tex. Agr. Expt. Sta. Bull. 397, 74 pp., illus. 1929.

value of the soils, the various soil types have been correlated into several established soil series which are widely distributed throughout the eastern Gulf Coastal Plain section of Texas. The soils occur in many intricately intermixed small areas, and in general each expresses differences in drainage conditions and in the character of the local beds of parent material underlying them, combined with the prevailing influences of the climate and the vegetative cover.

In only one soil, Nacogdoches fine sandy loam, is there a marked difference in color. The sandy topsoil of this soil is red or brown. This soil occurs in small areas in the southwestern part of the county and is representative of the "red lands" which are characteristic of certain sections of eastern Texas.

The upland soils have developed from the extensively outcropping beds which are geologically correlated with the Wilcox, Cook Mountains, and possibly some other formations of the Wilcox, and with the Claiborne of the Eocene period. In general the parent materials, from which the soils have developed, comprise deep beds of unconsolidated sand, sandy clay, or interstratified layers of clay and sand, in which thin layers of indurated sandstone occur in places. In some of these beds, which are composed of dark-green and dark-brown sands containing thin beds of iron ore and limonite, the material is, at least in part, of marine origin, and in places there are interbedded glauconitic sands and marls and some greensand marl. Probably most of the light-colored soils contain no material from greensand marl, and the formations containing large quantities of limonite and ironstone lie mostly beneath the red soils.

The bottom-land soils consist of deep deposits of soil materials washed from the sandy uplands within the county. They are mainly light colored and sandy, but they contain a rather larger quantity of silt in many places and for the most part are saturated with water during a considerable part of the year. In their present condition, although inherently productive, they cannot be utilized for crops. The soils along Sulphur River comprise alluvium made up of soil materials washed chiefly from the blackland prairies approximately 100 miles west of this county. This alluvium occurs in a wide strip of dark-gray or black heavy clay, and, according to field tests with hydrochloric acid, it is not calcareous.

Most of the land is sufficiently sloping to allow free run-off, and the friable and, in many places, very sandy subsoils and sandy substrata provide moderately free underdrainage. In only a few very inextensive upland areas is drainage so insufficient as to cause conditions too wet for producing farm crops, although some low swales or valleys receive seepage and drain slowly. In most places excess water drains quickly from the light friable sandy topsoils. The soils warm up fairly early in the spring, which favors the rapid growth of plants. This feature, together with the favorable climatic conditions, renders the soils favorable to the production of almost all kinds of plants. Practically all the soils are so deficient in organic matter and some of the essential plant nutrients, however, that high yields of crops are not generally obtained without careful management along the lines of soil improvement and by the addition of commercial fertilizers.

The soils in general are well suited to the production of vegetables, berries, small fruits, and such truck crops as potatoes, sweetpotatoes, melons, and various other vine crops. Owing to economic conditions, however, these crops have not been grown extensively on a commercial scale, although a few farmers at times have specialized in them with fair success. Practically all the farm land is devoted to the production of cotton and corn, and a small acreage is used for peas and various feed crops. The soils are highly suited to the production of large yields of cotton and corn where properly fertilized and where well-recognized methods of soil improvement and soil conservation, including the construction of terraces on the steeper slopes to minimize the removal of soil material by erosion, are employed. Owing to the uniform character of the topsoils and to the generally permeable character of most of the subsoils, variations in yields of the principal crops—cotton and corn—are not great on the different soil types, and differences in crop yields may be more definitely related to individual management, local conditions of erosion, quantity of fertilizer used, and other conditions than to differences in the character of the soils. Differences in soil characteristics are such that some soils respond more readily to fertilization and good management than others.

On the basis of soil characteristics and their general similarity in suitability for crops and productive capacity, the soils of this county may be included in the following six groups, each of which includes soils of approximately the same agricultural value under existing conditions: (1) Red soils, (2) light-colored soils with friable subsoils, (3) light-colored deep sandy soils, (4) light-colored soils with dense subsoils, (5) stony soils, and (6) soils developed from alluvium.

In the following pages the soils of Cass County are described in detail and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Cass County, Tex.*

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Nacogdoches fine sandy loam	2,176	0.4	Ruston fine sand	12,096	2.0
Ruston fine sandy loam	65,664	10.8	Susquehanna fine sandy loam	5,376	.9
Ruston fine sandy loam, deep phase	93,568	15.4	Leaf very fine sandy loam	10,752	1.8
Cahaba fine sandy loam	3,200	.5	Lufkin very fine sandy loam	1,472	.2
Bowie fine sandy loam	124,608	20.5	Kirvin fine sandy loam, stony phase	69,568	11.4
Kirvin fine sandy loam	81,472	13.4	Rough stony land	1,408	.2
Orangeburg fine sandy loam	2,816	.5	Bibb fine sandy loam	63,232	10.4
Caddo fine sandy loam	14,464	2.4	Ochlockonee fine sandy loam	6,976	1.1
Kalmia fine sandy loam	6,976	1.1	Johnston clay	20,928	3.4
Norfolk fine sand	17,856	2.9			
Kalmia fine sand	4,032	.7	Total	608,640	

RED SOILS

Nacogdoches fine sandy loam.—Nacogdoches fine sandy loam is the only representative of the red soils group in this county. It occurs in comparatively small areas scattered throughout the south-

western part, mainly within a few miles of Hughes Springs. This soil is typical of the east-Texas "red lands" which constitute a valuable and distinctive feature of several east-Texas counties, although they do not comprise a very large proportion of any one county.

This soil has developed, through the processes of soil development, from thick sandy beds which are unconsolidated but in places contain thin layers of sandstone. In the upper part and on the surface there are many fragments of ironstone and limonite. These beds are thought to be mostly of marine origin.

The 10-inch surface soil of Nacogdoches fine sandy loam consists of red or reddish-brown fine sandy loam containing a large quantity of small and fine dark ironstone fragments. This material grades into red smooth crumbly clay which contains small ironstone fragments and, below a depth of 20 or 30 inches, is slightly lighter red or yellowish red. Below a depth ranging from 4 to 5 feet the subsoil grades into the red parent material consisting of interbedded red clay and very sandy layers. The topsoil contains more fine material than the topsoils of other soils in the county, and this soil is, therefore, of slightly heavier texture than the other upland soils.

The relief ranges from gently to steeply rolling, and the soil occurs largely on the lower slopes of fairly steep hills capped with ironstone. Surface drainage is rapid, and the heavy crumbly subsoil is sufficiently permeable to provide adequate underdrainage. In general, this soil is not excessively eroded, although the rapid movement of excess water down the slopes doubtless causes considerable removal of fine earth and plant nutrients. Both surface soil and subsoil are acid in reaction.

This is an inherently productive soil suited to many kinds of crops. It is considered a stronger agricultural soil than any other upland soil. Owing to its favorable texture and structure, it is highly susceptible to improvement and responsive to fertilization. Barnyard manure, organic matter, and applications of commercial fertilizers are used to improve this soil.

Nacogdoches fine sandy loam is recognized as a highly desirable agricultural soil, and not less than 75 percent of it is in cultivation. The uncultivated areas support the original timber growth—chiefly pine, red oak, hickory, and blackjack oak. Practically all the cultivated land is devoted to cotton and corn. These crops are usually grown with the aid of commercial fertilizers, and acre yields, depending largely on the season and individual management, range from about one-fourth to three-fourths bale of cotton and from 20 to 35 bushels of corn.

The small home gardens and orchards on the farms show that this soil produces excellent yields of potatoes, various vegetables, peaches, other orchard fruits, and berries. It probably would prove excellent for the commercial production of many truck crops. On lower slopes, where the sandy material has accumulated through colluvial wash, good yields of sugarcane grown in small patches are produced, and the sirup is of high quality. In some other counties in Texas this soil has produced a very fine quality of cigar tobacco.

Table 4 shows the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Nacogdoches fine sandy loam.

TABLE 4.—*Mechanical analyses of Nacogdoches fine sandy loam*

Sample no.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
448826	Surface soil, 0 to 10 inches	2.2	5.2	3.7	24.6	26.6	24.2	13.5
448827	Subsurface soil, 10 to 40 inches	1.5	2.8	2.1	19.5	18.2	18.0	37.8
448828	Subsoil, 40 to 60 inches	3.8	3.1	1.6	21.0	22.2	12.7	35.6

LIGHT-COLORED SOILS WITH FRIABLE SUBSOILS

The light-colored soils with friable subsoils occupy the greater part of the upland area. These include Ruston fine sandy loam, Ruston fine sandy loam, deep phase, Bowie fine sandy loam, Kirvin fine sandy loam, Orangeburg fine sandy loam, Caddo fine sandy loam, and, on the smoother old stream terrace benches, Cahaba fine sandy loam and Kalmia fine sandy loam. These soils occur in small and some fairly large areas. They are very similar to one another in character of the topsoils, but the subsoils differ in some features, thereby giving rise to their differentiation into several soil series. These soils differ locally in features of slope and drainage, and, although, in general, they are component parts of the rolling land, they each have individual features of relief and of variations in underdrainage, which characterize their general location.

On these soils are based the major agricultural activities. They originally supported a timber growth of mixed pine and hardwoods, which still remains in many places. They all are farmed in about the same way, the same crops are grown, and, under the general system of management and fertilization, crop yields do not differ greatly on the various soil types. All these soils are acid in reaction, and the topsoils are low in organic matter.

Ruston fine sandy loam.—Ruston fine sandy loam is one of the most extensive soils. It occurs in both small and large areas throughout most sections. Probably it is most extensive in smoothly rolling areas in the northeastern part where it is associated largely with Bowie and Kirvin fine sandy loams.

The surface layer of Ruston fine sandy loam consists of gray loamy fine sand which grades, at a depth of about 10 inches, into yellow, dull-yellow, grayish-yellow, or brownish-yellow loamy fine sand. This, at a depth of 12 or 15 inches, merges with the subsoil of light reddish-yellow or yellowish-red friable fine sandy clay. With increase in depth the subsoil becomes slightly more yellow, and it is reddish yellow to a depth ranging from 3 to 4 feet, where it grades into the parent material of mottled red and gray fine sandy clay. The topsoil is very light in color, contains a few fine ironstone fragments, and for the most part is low in organic matter. The material in this layer is loose and very slightly coherent, and it absorbs water rapidly. The subsoil and substratum are crumbly and friable and allow free passage of water, which allows, in most places, good underdrainage and easy penetration by air and plant roots. The relief is undulating or gently rolling. In the vicinity of some deeply cut valleys some slopes are steep.

Surface drainage is good, and although some of the steeper slopes suffer from excessive erosion during long-continued downpours of rain, the absorptive capacity of the topsoil and the permeability of the subsoil and substratum allow the retention of a large proportion of the ordinary rainfall. Doubtless leaching, especially laterally down slope, causes the removal of many soluble plant nutrients. The native vegetation consists chiefly of shortleaf pine, sweetgum, red oak, blackjack oak, and hickory.

This soil is of moderate productiveness, and it responds well to good management and fertilization. Probably about 70 percent of the land is cleared, and a large proportion, probably 70 percent, of the cleared land is used for crops, principally cotton and corn, which are produced mostly with the aid of commercial fertilizers. About 70 percent of the crop land is devoted to cotton, about 25 percent to corn, and the rest to the production of vegetables, truck crops, and fruits in the small home gardens and orchards. The introduced pasture grasses are mainly Bermuda and Dallis grasses. Small quantities of sorgo, peanuts, field peas, and other minor crops are produced on some farms. Cotton yields range from one-third to one-half bale an acre and corn from 20 to 30 bushels. Yields may be much lower on eroded areas, or in places where long-continued cropping has been exhaustive and has caused depletion of plant nutrients and organic matter. Failure to practice well-recognized methods of soil improvement has also reduced yields.

Much of this land has been terraced to minimize erosion, and some farmers, by practicing careful cultivation and by employing approved methods of soil improvement, consistently produce moderately high yields of all crops.

This soil is especially suited to the production of many vegetables, berries, small fruits, and peaches, but attempts at the commercial production of these products have been sporadic and, according to local information, have not proved generally satisfactory because of low prices and unfavorable marketing conditions. Structurally the soil seems well suited to the growth of pecan trees, and some plantings of these are observed to be in good condition. It is probably necessary, however, to add considerable organic matter and to fertilize the land correctly in order to insure good growth and production of pecans. Some potatoes and sweetpotatoes are grown and return good yields when fertilized. If economic conditions favor the more extensive production of these and other truck crops, this soil would be very suitable for the purpose.

A number of pasture grasses do well, thus favoring dairy farming. This branch of the agricultural industry is not established, however, although some surplus milk, cream, and butter are marketed locally. Fruit and vegetable crops mature at a fairly early date on this soil, and it is reported that strawberries may be brought into bearing about the middle of April, potatoes between the last of May and the middle of June, and peaches about June 1.

Thus it may be seen that Ruston fine sandy loam is a very valuable soil for vegetables and fruits and probably is one of the best extensive soils for these crops. Many good-sized areas are convenient to highway- and railroad-transportation facilities, and in such places

specialized farming, as truck and fruit growing and dairy farming, could be advantageously developed.

Ruston fine sandy loam, deep phase.—The deep phase of Ruston fine sandy loam differs from the typical soil only in that the subsurface sandy layer is thicker and the clay subsoil lies at a depth ranging from 20 to 30 inches.

A 12-inch layer of gray fine sand comprises the very loose incoherent topsoil which contains a large quantity of very fine sand and a very small quantity of organic matter. This material grades into pale-yellow or yellowish-gray fine sand which, at a depth of 24 inches, grades into reddish-yellow fine sandy clay. The clay, at a depth ranging from 4 to 5 feet merges with the yellow or reddish-yellow fine sandy clay parent material, in which there may be some gray coloration. Owing to the high fine sand content, friability, and porosity of all the soil layers and the substratum, underdrainage is free, and this condition allows fairly rapid leaching. The relief, for the most part, is moderately smooth, as this soil occurs mainly on the broader divides and undulating ridges. In places it extends down some fairly steep slopes. Surface drainage is good. The rapid absorptive quality of the soil, together with the generally gently sloping relief, largely prevents excessive erosion.

This is one of the most extensive soils in the county. It occurs in many small and moderate-sized bodies in nearly all parts, but in the northern part there is little of it. It is associated with areas of most of the other upland soils, chiefly with bodies of typical Ruston fine sandy loam and with the Kirvin and Bowie soils.

This is one of the most extensively cultivated soils, probably about 60 percent having been cleared of the timber growth, and a rather large proportion of this cleared land is devoted to crop production. The crops grown are the same and they occupy similar proportionate acreages as on the typical soil. Owing to the deeper sandy covering and, therefore, freer leaching, this soil is not considered quite so productive for general farm crops as the typical soil. Cotton is said to yield about one-fourth bale and corn from 15 to 20 bushels an acre. Although grown only in small patches for local use, vegetables, berries, and orchard fruits do especially well, and the soil could be used extensively for the production of many such crops on a commercial scale. It is especially suited to watermelons. Some watermelons are grown successfully for the local markets, and when economic conditions are favorable some are shipped to outside markets. The land is also especially well suited to sweetpotatoes, strawberries, blackberries, and plums. Some sweetpotatoes grown for market produce from 100 to 150 or more bushels an acre.

Crops grown on this soil are fertilized with commercial fertilizers. The staple farm crops receive about the same applications and kinds as are used on the typical soil, but vegetables grown for the market receive heavier applications or more concentrated fertilizers.

From results noted in other places, as well as here, on soils of similar character, it seems that this would be a soil well suited to the commercial production of melons and other vine crops, including sweetpotatoes, cucumbers, squash, most kinds of berries, plums, and

small fruits. Probably this would be a very good soil for the production of asparagus.

Cahaba fine sandy loam.—Cahaba fine sandy loam is almost identical with Ruston fine sandy loam in soil characteristics, but it occupies high ancient flat stream terraces, and surface drainage is less free than on the Ruston soil.

The 5-inch surface layer of Cahaba fine sandy loam consists of gray loamy fine sand which grades into dull-yellow loamy fine sand continuing to a depth of about 12 or 15 inches. This material, in turn, grades into dull brownish-yellow, reddish-yellow, or yellowish-red friable fine sandy clay which extends with little change to a depth ranging from 30 to 40 inches. It grades into a bed of parent material consisting of mottled gray and yellow fine sandy clay. The relief is undulating or slightly billowy, with some large but low smoothly rounded sand mounds, between which are slight depressions of small extent. The general surface is flat and characteristic of the very old stream terraces. In the depressions the subsoil is slightly mottled, and here the parent material lies within about 3 feet of the surface and seems to contain more clay than elsewhere.

This soil, which is of slight extent, occurs in only a few small widely scattered areas. Probably 90 percent of the land is cleared and is used for the same crops as those grown on Ruston fine sandy loam, with similar yields. In agricultural productiveness and crop adaptation, this soil is practically the same as Ruston fine sandy loam. Owing to its slightly smoother relief and the occurrence of depressions, the areas are not quite so well drained and do not suffer quite so much from erosion and lateral leaching as do areas of Ruston fine sandy loam.

Bowie fine sandy loam.—The surface soil of Bowie fine sandy loam consists of a 5-inch layer of gray loamy fine sand grading into pale-yellow loamy fine sand which, at a depth of about 10 inches, passes gradually into a subsoil of yellow crumbly friable fine sandy clay. Below a depth of about 26 inches, the subsoil contains small red spots and splotches, many of which have centers of soft dark concretions. Below this layer, at a depth of about 30 inches, the material is mottled red, gray, and yellow friable and permeable fine sandy clay. Below a depth ranging from 4 to 5 feet, this clay grades into parent material of gray and yellow clayey sand or sandy clay, which, on drying, becomes very hard.

The topsoil is very loose, very slightly coherent, and contains very little organic matter. This is one of the most extensive soils. It occupies fairly smooth undulating and gently sloping areas associated with, but generally lying slightly lower than, the Ruston and Kirvin soils. The surface soil and subsurface soil are so loose that they allow fairly rapid leaching, but the subsoil and parent material contain sufficient clay to render their water-holding capacity sufficiently great to retard water from passing rapidly downward. The rather flat smooth relief and low position cause comparatively slow removal of subsoil water downward in many places, and this condition allows some accumulation of water or passage of lateral seepage from the slightly higher lying soils, thereby causing slower drainage than in the Ruston and Kirvin soils. Although the Bowie soil has

adequate drainage for growing crops, it does in many places dry out a little later than many other soils, and in such places crops may get a little later start and not develop so rapidly early in the season as on some of the more freely drained soils.

The timber growth is practically the same as that on the other soils of this group, but possibly there is a slightly larger proportion of sweetgum. Probably about 50 percent of the land has been cleared, and a large proportion of this is devoted to farm crops. The soil is of only moderate productiveness. It is used for the same crops, with approximately the same yields of cotton and corn, as is Ruston fine sandy loam. Owing, possibly, to slightly poorer drainage, yields are slightly lower than on the Ruston soil. Because of the less sloping relief and, therefore, less tendency to erosion, it is probable that yields in places might be equally as good as, or slightly better than, on some of the more steeply sloping areas of the Ruston soil. On the whole, crop growth on this soil is slightly later in developing than on the Ruston soil, and it might not be quite so satisfactory for the production of early spring vegetables. It is said that the condition of atmospheric drainage is not quite so satisfactory for the production of fruit as that of the higher lying soils, as this feature causes slightly less freedom from late frost damage.

Kirvin fine sandy loam.—The 6-inch surface layer of Kirvin fine sandy loam consists of gray loamy fine sand which contains a few fine dark ferruginous sandstone fragments. This material grades into pale-yellow loamy fine sand which in places contains fine ironstone fragments, and this layer, in turn, at a depth ranging from 10 to 14 inches, grades, through a short transitional zone, into red or brownish-red moderately heavy crumbly slightly sandy clay. At a depth of about 24 inches this material changes to the red and gray mottled crumbly heavy clay subsoil containing thin layers of ironstone fragments. Below a depth ranging from 3 to 4 feet the clay grades into the parent material of interbedded layers of red and yellow sandy beds containing thin strata of gray clay mottled with red. In places fine glistening particles in this material resemble mica. The topsoil is very low in organic matter, and the soil in all layers is acid in reaction. The topsoil is loose and friable and has but slight coherence. On steep slopes the clay subsoil is in places rather thin and not deeply red. Good-sized areas in the northwestern part of the county are underlain by a subsoil that is rather more friable and sandy than that in other places.

This in an extensive soil, and it occurs in widely scattered bodies. Some large areas are in the northwestern part associated with Bowie fine sandy loam. The Kirvin soil occupies high rolling uplands and ridges and crests of narrow divides. It is, therefore, rather steeply sloping in many places. It is associated for the most part with the Ruston and Bowie soils.

The top sandy layers are comparatively thin and for this reason cannot absorb a large quantity of water. As the subsoil is moderately heavy and of rather slow penetrability, it does not allow rapid accumulation of rain water, and consequently, during heavy rains, the steeper slopes allow the rapid flow of water with consequent severe erosion which in places has caused considerable gullying and the removal of much of the topsoil. In places the subsoil is exposed.

Because of susceptibility to erosion, much of the land has been terraced. It is noticed that broad-based terraces are holding better than narrow high ridgelike terraces.

Kirvin fine sandy loam is of moderate productiveness, and it responds well to fertilization and soil improvement. On the steeper slopes, especially where there has been severe erosion, crops suffer at times during long periods of dry weather. This droughty feature is more pronounced than with other soils which have the deeper sandy covering. The larger areas having a thicker topsoil, near Douglassville and in the northwestern part of the county, are somewhat steeper and more productive than areas elsewhere. Probably 60 percent of the land is cleared of the original timber growth which consisted of similar mixed pine and hardwood forest as that on the associated soils. Probably 80 percent of the cleared land is devoted to cultivated crops. Cotton and corn are practically the only crops grown. Small acreages are in pastures and home gardens. The same system of farming is in practice and the same kinds of commercial fertilizer are used as on Ruston fine sandy loam, and yields are in general about the same or perhaps slightly lower than on that soil.

Much of the crop land that is terraced shows, through added productiveness, that terracing is a valuable improvement. The soil is responsive to improvements and fertilization and, when managed carefully, very good yields of farm and truck crops can be obtained. The soil is highly suited to the production of potatoes, sweetpotatoes, truck crops, orchard fruits (especially peaches and pears), and berries. It seems that a practice of keeping the steeper slopes in valuable soil-saving crops, such as grasses, would be preferable and, in some places where erosion appears especially injurious, that reforestation to pine would be preferable to utilizing the soil for cultivated crops.

Orangeburg fine sandy loam.—The 4- to 6-inch surface layer of Orangeburg fine sandy loam consists of brownish-gray loamy fine sand. It is underlain by brownish-yellow or reddish-yellow loamy fine sand which extends to a depth ranging from 14 to 18 inches. Below this and extending to a depth ranging from 2 to 4 feet is red friable fine sandy clay or, in places, heavy fine sandy loam, which is very permeable and crumbly. The clay subsoil grades into reddish-yellow and gray mottled loamy fine sand which packs very hard when dry.

This soil is of very slight extent and occurs in only a few small widely separated areas in various parts of the county. The largest bodies are southeast of Hughes Springs on a high smooth old alluvial bench in the Hughes Creek Valley. The surface soil and subsoil layers are acid in reaction, and the topsoil contains very little organic matter. The relief is smoothly undulating, and both surface drainage and underdrainage are very good. On account of the friable and easily permeated topsoil, the absorptive capacity of this soil is good, and there is little run-off of rain water. In the lower layers the soil mass is sufficiently heavy for the retention of large quantities of soil water which can be used by growing plants.

About 70 percent of the land is cleared and used for crops. The same system of cotton and corn farming prevails as on Ruston fine sandy loam, and crop yields are on the whole somewhat higher than

on that soil. The Orangeburg soil is highly suited to the production of most truck crops, berries, and orchard fruits. Probably it would produce excellent asparagus, cucumbers, cantaloups, and peas, and it should prove very desirable for peaches, pears, and plums. Owing to its small extent, this soil is not important agriculturally. It responds splendidly to methods of soil improvement and to the application of commercial fertilizers.

Caddo fine sandy loam.—The topsoil of Caddo fine sandy loam consists of an 8-inch layer of gray fine sandy loam containing a large quantity of silt and very fine sand and very little organic matter. This material grades into pale-yellow fine sandy loam which continues to a depth of about 20 inches. In places in this layer, there is a slight mottling of gray, and throughout the layer are a few small black concretions, some of which are soft. This layer is underlain by yellow fine sandy clay mottled with gray, and this, at a depth of about 3 feet, grades into yellow and gray mottled fine sandy loam which in places contains some layers of clay material. In some areas, which appear to be old second-bottom terraces, are small quantities of mottled yellow, red, and gray clay at a depth ranging from 2 to 3 feet. No hardpan or claypan material is present beneath this soil.

The relief is very flat, and the surface is dotted with numerous low smoothly rounded sand mounds which in places occupy most of the land. Between these, the slight depressions are very wet and slowly drained, but during the warm seasons they dry out entirely.

This soil is not very extensive. It occupies a few areas in the eastern part of the county, some of which have the appearance of old stream terraces. Although occupied by a heavy growth of pine and hardwoods, there seems to be a predominance of sweetgum, and this gives rise to the local name of "sweetgum flats."

Practically none of this land is in cultivation, owing doubtless to the very slow drainage and late drying out in the spring. On the few patches that are farmed, cotton and corn are grown, and yields are ordinarily lower than those obtained on Ruston fine sandy loam. Both surface soil and subsoil are acid in reaction and deficient in organic matter. With proper drainage, this soil would respond favorably to the application of commercial fertilizers and improved methods of soil improvement.

Kalmia fine sandy loam.—Kalmia fine sandy loam has a 12-inch layer of gray fine sand grading into mottled gray and yellow fine sandy loam or fine sandy clay, which, below a depth of about 30 inches, changes to yellow and gray mottled fine sandy loam. The surface soil is acid in reaction and low in content of organic matter.

The relief is nearly flat and represents a very high undulating bench in the larger stream valleys, apparently a stream terrace of ancient sedimentation. Smoothly rounded sand mounds occur over most of the land. These consist of gray fine sand, to a depth of 24 inches, underlain by yellow friable fine sandy clay which is slightly mottled with gray at a depth ranging from 30 to 40 inches. The soil between the mounds, which in places is less extensive than the mounds, is very wet and poorly drained throughout most of the cooler months of the year.

A large proportion of the land has been cleared of the mixed pine and hardwood growth and is cropped to cotton and corn in the manner employed throughout this section. This is a late-maturing soil which has similar soil characteristics and about the same agricultural value as Caddo fine sandy loam.

LIGHT-COLORED DEEP SANDY SOILS

The group of light-colored deep sandy soils includes timbered areas of smooth land which occur in a number of small widely scattered bodies throughout most of the county, except the northeastern part. These soils are light in color and have subsoils which are almost identical with the topsoils in structure and texture. They are occupied by a timber growth of pine and various hardwoods, chief of which are blackjack oak, post oak, and hickory, and in addition are characterized by a peculiar oak, known as sand jack oak, which does not grow on any soil with a clay subsoil. These soils are less extensively cleared and cultivated than most of the other upland soils. They are somewhat lower in inherent productiveness than the principal farming soils but where farmed are used in the same way for the same farm crops. Norfolk fine sand, Kalmia fine sand, and Ruston fine sand are the members of this group.

Norfolk fine sand.—The topsoil of Norfolk fine sand consists of loose incoherent fine sand which is very low in organic matter. At a depth of about 7 inches this passes into pale-yellow fine sand which is many feet thick. Both surface soil and subsoil are acid in reaction.

This soil occurs in a number of moderate-sized bodies a mile or more wide, in various parts of the county. It occupies high undulating areas, some of which are ridges, and there are no severe slopes. One of the largest areas is near the village of O'Farrell.

Probably one-half of the land is cleared of its native vegetation and is used mainly for cotton and corn. Small acreages are devoted to vegetable crops required for home use. Ordinarily the crops are grown with the aid of fertilizer. Under normal climatic conditions and the ordinary methods of management, cotton yields from one-fourth to one-third bale an acre and corn about 20 bushels. Owing to the high absorptive capacity of the surface soil and subsoil, practically all the rainfall is taken up in the soil mass, but because of the porosity of the mass, much of the water passes downward and leaches out a large proportion of the plant nutrients. For this reason, in some rainy seasons, the more valuable constituents of the commercial fertilizers may be washed out and lost to the use of crops. It is suggested, therefore, that it is usually more advantageous to apply at least a part of the commercial fertilizers as a side dressing at various times during the season, after the plants have made a good growth. This soil has been found to respond very quickly to applications of fertilizers containing nitrogen and phosphoric acid and to the incorporation of organic matter. Owing to the comparatively large proportion of the larger soil grains composing the soil, soil water is taken up more readily by plants than from soils containing a very large proportion of clay particles. Therefore, in very dry seasons the soil moisture is more thoroughly extracted by plant roots, and crops sometimes

withstand long periods of dry weather better than those on very heavy soils. This soil is better suited to the production of watermelons and similar vine crops, sweetpotatoes, blackberries, and plums than to general farm crops. Many vegetables will grow well and produce fair yields.

Kalmia fine sand.—Kalmia fine sand is very similar to Norfolk fine sand in soil characteristics, but it differs from that soil in that it occupies very flat positions on high benches which apparently represent old stream terraces.

The 6-inch surface soil is gray fine sand, but in the virgin forest areas the upper 3 inches contain an accumulation of very dark very finely divided organic matter. The material in this layer grades into yellow or pale grayish-yellow loose fine sand which is many feet thick. The relief is flat or undulating, but the absence of a heavy subsoil renders underdrainage sufficiently free to prevent the accumulation of free water in the soil except during very wet seasons. Practically all the land remains in the original forest growth, accompanied by a rather heavy undergrowth of poison-oak, ferns, and shrubs, with here and there clumps of beargrass. This soil occupies only a few small areas in the southern part of the county. It has about the same potential agricultural value as Norfolk fine sand and is suited to growing the same general crops as are grown on that soil.

Ruston fine sand.—The 10-inch topsoil of Ruston fine sand is brownish-gray fine sand. It grades into reddish-brown or light brownish-red fine sand which is very slightly loamy and which, below a depth ranging from 30 to 40 inches, is brownish-yellow fine sand. The soil is very loose and contains only a slight amount of organic matter.

This soil occupies high undulating ridge crests and has very free underdrainage. In texture and structure it is very similar to Norfolk fine sand. The subsoil is more red than that of the Norfolk soil, and all the soil layers appear to contain a very slightly larger quantity of clay and silt particles.

Ruston fine sand is of slight extent. It occurs in some fairly large areas, mainly in the central, southwestern, and southeastern parts of the county. It supports a forest growth similar to that on Norfolk fine sand. About 60 percent of the land is cleared, and most of the cleared land is devoted to the production of cotton and corn, which yield approximately the same, or probably slightly more, than on Norfolk fine sand. The crop adaptations and productive capacity of this soil are very similar to those of Norfolk fine sand.

LIGHT-COLORED SOILS WITH DENSE SUBSOILS

The light-colored soils with dense subsoils differ materially in subsoil characteristics from soils of the friable-subsoil group, in that they are underlain by dense clay subsoils, of claypan character, through which water penetrates very slowly and in which deep root systems do not allow development freely. Underdrainage of these soils is slow and in places where the land is very flat saturation of the topsoil continues throughout long periods. For the most part these soils dry sufficiently to allow cultivation, but they are not

considered to be so good agriculturally as the light-colored soils with friable subsoils.

The soils having dense subsoils support a heavy forest growth of pine and mixed hardwoods. Post oak, blackjack oak, hickory, and gum predominate, and in some of the wetter flats water oak and willow oak are prominent. On the basis of minor differences of subsoil character, these soils are separated into Susquehanna fine sandy loam, Leaf very fine sandy loam, and Lufkin very fine sandy loam. They are acid in reaction throughout. Practically none of these soils is in cultivation. They are of slight extent and retain much of the original timber.

Susquehanna fine sandy loam.—The 4-inch surface layer of Susquehanna fine sandy loam is brownish-gray fine sandy loam containing a few fine brown and yellow spots throughout. It grades into pale-yellow fine sandy loam which, at a depth of about 10 inches, rests on dense red and gray mottled clay. The gray color increases with depth, and below a depth of 24 inches the clay is dense, slick, and brittle. In places, below a depth of 40 inches, it contains small lumps of gypsum crystals.

This soil is of very slight extent. It occupies only a few small areas in the northern part of the county, mostly in association with Bowie fine sandy loam. The relief is for the most part smooth, and the slopes are very gentle. In places where the land is flat, slight inequalities produce a "hog-wallow" condition, and the surface soil on the miniature mounds is only 1 or 2 inches thick. In addition to the common mixed forest of hardwood and shortleaf pine there is, in flat places, some willow oak.

Practically none of this soil is in cultivation. Owing to the dense subsoil and poor underdrainage it is not considered especially valuable for crops, and probably its best utilization is for the growth of timber. In other counties where this soil is farmed, only very moderate yields of the general farm crops are obtained. The soil may be improved by the incorporation of organic matter and by the application of fertilizers.

Leaf very fine sandy loam.—The topsoil of Leaf very fine sandy loam consists of gray slightly coherent very fine sandy loam to a depth of about 6 inches, where it grades into light-yellow or light-gray very fine sandy loam which in places has a mottled yellow and gray color. This material grades, at a depth of about 10 inches, through a very short transitional layer, into very dense heavy clay mottled red and gray. The gray color increases with depth, and below a depth of about 20 inches the material is dense waxy clay mottled gray, red, and yellow. Below a depth of about 5 feet the clay subsoil is gray fine sandy clay containing some yellow splotches and streaks. This soil is low in organic matter and is acid in reaction throughout. The prevailingly flat relief is slightly billowy in many places, owing to the presence of low smoothly rounded sand mounds. Leaf very fine sandy loam is very similar to Susquehanna fine sandy loam in soil characteristics. The relief of the Leaf soil, however, is more nearly flat, and natural drainage is not so good. The topsoil is also somewhat thicker than that of the Susquehanna soil, and probably for this reason the Leaf soil is potentially more productive.

This soil is not extensive. It occurs in a number of moderate-sized bodies on a high terrace in the northern part of the county, at the south edge of the Sulphur River first-bottom lands, above which it lies at a height ranging from 10 to 20 feet. Although it is composed of old stream sediments, the land is no longer overflowed by the river. The flatness of the land prevents good surface drainage, and the dense subsoil prevents free underdrainage. Therefore, the soil remains wet and saturated during the cooler seasons of the year. The original timber growth of pine and hardwoods covers practically all the land, and willow oak and water oak are characteristic of the depressions which are wet much of the time. This soil is of moderate productiveness, but for best results in cultivation it would require artificial drainage. In other counties where soil of this kind is farmed, moderate yields of cotton and corn are obtained. For satisfactory returns, soil-improvement practices and fertilization are required. Where well drained the land is suited to the production of vegetables and berries.

Lufkin very fine sandy loam.—The 14-inch topsoil of Lufkin very fine sandy loam consists of light-gray silty very fine sandy loam which dries to a rather hard compact mass. It is underlain by gray silty clay loam which grades, at a depth of about 24 inches, into very dense heavy gray clay that contains small yellow spots in some places. In places the dense clay lies immediately beneath the sandy topsoil. The surface soil and subsoil layers are acid in reaction.

This soil is of very slight extent and occurs in only a few small areas in the southeastern part of the county. The land is flat and slightly depressed, so that water stands for a long time in wet seasons, as the dense subsoil is almost impervious. The native vegetation is mainly pine, with a large amount of willow oak and water oak. None of the land is cleared or cultivated. Although probably a moderately productive soil, its use for cultivated crops is entirely impractical under present conditions of drainage, and its best utilization is for the production of timber.

STONY SOILS

The group of stony soils consists of soils which are more or less stony, although, in places, little stony material is present in the surface soil. These soils are sandy, mostly of light color, acid in reaction, and low in organic matter. They occupy a number of small and good-sized areas, chiefly throughout the southern part of the county. Most of the areas are mapped as Kirvin fine sandy loam, stony phase, and there is a small proportion of rough stony land.

Kirvin fine sandy loam, stony phase.—The 6-inch surface layer of Kirvin fine sandy loam, stony phase, consists of gray fine sand. This grades into yellow fine sand which, at a depth ranging from 15 to 24 inches, grades into red crumbly fine sandy clay. A small quantity of iron sandstone fragments occur throughout the topsoil, but this stony material is not everywhere present on the surface and in many places occurs chiefly near the bases of the topsoil layers. Fragments comprise thin strata of the stony material in the subsoil, and to some extent this condition prevails in the upper part of the parent material.

The stony phase of Kirvin fine sandy loam occupies steep slopes and some ridges. It has free surface drainage, but underdrainage is slow. It occupies small and moderately large bodies of land, mostly in the southern part of the county. It is nearly all still covered with pine, post oak, blackjack oak, and hickory timber. Small areas have been cleared and are farmed, but probably not over 10 percent is utilized for crops. Where the land is not very stony, yields of cotton and corn are approximately the same as on Ruston fine sandy loam, but on the more stony and shallow areas, yields are lower. Much of this soil is probably better suited to producing timber than to cultivation for crops.

On many narrow steep slopes, at the crests of ridges, and on the upper slopes there are small areas of Kirvin stony fine sandy loam, which, because of their slight extent, are not mapped separately. This included soil consists of a 6-inch layer of gray fine sand which grades into yellow fine sand. This, in turn, at a depth ranging from 10 to 15 inches, is underlain by red crumbly clay. The stony material consists of small and some large flat fragments of iron sandstone and some of concretionary ironstone which is very abundant in places. The subsoil also contains stony material. On account of its slight extent, a small area of Nacogdoches stony fine sandy loam is included with this soil, and it has a similar low agricultural value. Also included are some small areas of the Ruston and Bowie fine sandy loams.

Rough stony land.—Rough stony land represents excessively stony areas of Kirvin stony fine sandy loam. It is confined to a few small bodies which occupy steep, rounded, rather sharp crested hills rising abruptly above the surrounding country. Large and massive iron sandstone fragments cover practically all the surface. The land is unsuited to any purpose except the growth of trees which are largely shortleaf pine. This land, as well as much of Kirvin fine sandy loam, stony phase, is used for pasturing farm livestock, and the scant growth of coarse grasses affords some forage for the animals. Possibly by clearing away the underbrush, some valuable pasture grasses could be introduced to render more effective pasturage of these soils in conjunction with growing timber.

SOILS DEVELOPED FROM ALLUVIUM

The soils included in the group of soils developed from alluvium occupy a very large proportion of the total land area, although for the most part they do not occur in large areas. These soils occur in narrow strips ranging in width from a few hundred feet to 1 mile along all the streams except along Sulphur River where bodies of the first-bottom lands are in places more than 2 miles wide. These soils occupy the flood plains of the streams and lie only slightly above the normal stream level. They comprise very deep beds of soil materials washed from local areas and deposited in the valleys during periods of inundation. In most of the county, therefore, these soil materials are of light color and sandy texture, indicating their origin from the local upland soils. Along Sulphur River, however, the soils develop very largely from dark soil material washed from the blackland prairies where this stream originates.

These so-called "alluvial" soils are for the most part low, flat, and semiswampy. They are overflowed frequently, and even when not overflowed the rainfall is sufficient to keep them saturated throughout much of the year. Only small areas of the Ochlockonee and Johnston soils have sufficient natural drainage to allow successful cultivation, but practically all the land is occupied by a heavy timber growth consisting very largely of water-loving and water-tolerating trees, together with a comparatively small amount of pine.

Only three soils are mapped on the alluvium of this county—Bibb fine sandy loam, Ochlockonee fine sandy loam, and Johnston clay. The Ochlockonee and Johnston soils are of high productive capacity, as indicated by the good yields obtained on the cultivated areas, but for the most part farm crops cannot be grown unless adequate systems of drainage and protection from overflows are provided. Where it is not feasible to protect the land from overflows or to provide good drainage, it seems that good pastures could be developed by the introduction of grasses, after deadening all or many of the trees.

Bibb fine sandy loam.—The topsoil of Bibb fine sandy loam consists of a 14-inch layer of light-gray fine sandy loam containing a few yellow and brown spots and splotches. This material grades into mottled gray and yellow clay loam or clay, which continues to a depth of several feet. Throughout the wider bottoms, considerable variation occurs in the texture of the topsoil and subsoil. In places the topsoil is very fine sandy loam, but in most places it contains a large quantity of silt, some small areas being so silty that the texture is silt loam or silty clay loam. The subsoil in many places is gray fine sandy clay containing brown splotches and some yellow coloration. Dark round concretions surrounded by brown spots occur throughout the subsoil.

The relief is flat, and in places smooth mounds of deep fine sand are present. This is a very wet soil during most of the year. The land supports a heavy growth of timber, consisting chiefly of willow oak, water oak, water maple, bur oak, gum, cypress, and a small amount of pine. The pine trees, together with bur oak and white oak, appear to prefer the least wet places, and many of them grow on the sand mounds. None of this soil is in cultivation.

Ochlockonee fine sandy loam.—The surface layer of Ochlockonee fine sandy loam consists of dark-gray fine sandy loam about 8 inches thick. This grades into yellowish-brown or grayish-brown clay loam which may have a slight mottling of gray. At a depth of about 2 feet, the subsoil is gray silty clay loam or clay, streaked and splotched with bright yellow.

This soil is of but slight extent and occurs in only a few small strips in the western part of the county. The land is flat, and natural drainage is slow. Overflows occur occasionally. This soil, however, is better drained than the Bibb soils, and some of it is in cultivation. The surface soil and subsoil have the same soil characteristics as the corresponding layers of Bibb fine sandy loam, but, owing to the slightly better drainage and less swampy character of the Ochlockonee soil, the differentiation was made.

The timber growth is very similar to that on Bibb fine sandy loam. Small areas have been cleared, and some cotton, corn, and sugarcane are produced. These crops are grown without the aid of fer-

tilizers, and, during seasons that are not too wet, cotton produces one-half bale or more an acre and corn from 25 to 30 bushels. The better drained areas are said to produce a fine quality of ribbon cane sirup. The establishment of good carpet grass and Bermuda grass pastures seems to be satisfactory on the meadows of this soil.

Johnston clay.—Johnston clay consists of black very heavy clay to a depth of 6 or 8 inches. This grades into light bluish-gray waxy clay containing fine rust-brown spots. Although very dark and resembling Trinity clay, this soil has a lighter gray subsoil and shows, by its slight brown and yellow mottling, the influence of very poor drainage. None of the soil shows effervescence with hydrochloric acid, and probably in most places it is only slightly acid in reaction.

This soil occurs entirely along Sulphur River in the northern part of the county, where it occupies some good-sized very flat and very poorly drained areas which lie only slightly above the normal water level of the stream. Overflows are frequent, and the soil remains wet during the cooler seasons of the year.

The principal timber growth is elm, willow oak, bur oak, water oak, ash, and a few pines. Under present drainage conditions, it is not feasible to attempt cultivation of this soil. It is inherently of high productiveness, and, if protected from overflows and provided with suitable drainage, it should produce excellent yields of the crops to which it is best suited—probably cotton, corn, and various feed crops including the sorghums and pasture grasses.

SOILS AND THEIR INTERPRETATION

The maturely developed soils of Cass County show marked similarity in their general profile characteristics. The topsoils are light colored, acid in reaction, low in organic matter, excessively leached, and low in available plant nutrients. They are for the most part underlain by subsoils of clay, made up of layers of distinctive features of alluviation, are acid in reaction, and overlie parent materials of unconsolidated sandy beds, throughout which occur, in places, more or less heavy clay or sandy clay strata. Differences in character of parent material and of features of surface drainage have caused considerable variation in the characteristics that have developed in the subsoils in various places. Differences in color, texture, structure, permeability, and chemical constituents have therefore been produced by local variations of the factors of regional environment.

The soils have been developed from noncalcareous unconsolidated beds of sand and clay in a warm climate characterized by long hot summers and short cool winters, with a high rainfall, and beneath a dense uniform forest growth which furnishes very little organic matter to the soil.

Most of the soils may be included in the group of light-colored leached soils which may possibly be considered as of slightly podzolic character. Another group of soils developed from parent materials rich in iron and iron compounds and which probably contain some greensand marl includes deep-red soils which, having an accumulation of iron sandstone and limonite, may be termed lateritic in character.

The relief for the most part ranges from gently rolling to very rolling, and surface drainage is rapid. In most places the soil material and substrata are sufficiently permeable to allow free downward movement of excess soil water.

The topsoils are very similar in texture. They consist mostly of light fine sand containing very little silt and clay. All the soils are easy to cultivate, as they are very loose and friable. Some areas, however, are too stony to allow easy cultivation. The land has been deeply cut by many local streams, which have carved numerous shallow and deep valleys, in the vicinity of which the slopes are steep.

The light-colored soils occupy the greater part of the upland. These soils are included in two subgroups: (1) Soils having friable and readily permeable crumbly subsoils, and (2) soils having dense heavy clay subsoils.

The soils having friable permeable subsoils are well illustrated by Ruston fine sandy loam which occupies the smoother undulating or gently rolling higher lands. In a deeply cut bank 5 miles southeast of Atlanta the profile described below was observed.

1. 0 to 10 inches, gray fine sand.
2. 10 to 14 inches, yellow fine sand.
3. 14 to 30 inches, yellowish-red or reddish-yellow crumbly fine sandy clay which on drying separates into fine angular clods.
4. 30 to 48 inches, mottled reddish-yellow and gray fine sandy clay.
5. 48 to 70 inches, reddish-yellow fine sandy clay containing red splotches.
6. 70 to 140 inches, stratified yellow and gray pack sand which on drying becomes very hard.
7. 140 to 180 inches, stratified gray shaly clay containing some very fine sand and some interbedded layers of gray and yellow very fine sand.
8. 180 to 230 inches, yellow hard fine sand.

Layers 1 and 2 comprise the A horizon which is very similar in texture to this horizon in all light-colored soils of the county. The gradual change of horizon A to the B, or clay, horizon is characteristic of all soils of this subgroup, and therefore these soils are distinctly not claypans. Layers 3 and 4 comprise the B horizon, the lower part of which (4) is the gradational zone between the developed B horizon and the parent material. On some steep slopes it was noted that layer 3 is only about 6 inches thick, layer 4 only about 12 inches thick, and layer 5, which represents the slightly weathered part of the parent material, lies much nearer the surface than in the smoother locations where erosion is less rapid. The deep phase of this soil, which is more extensive than the typical soil, represents a deeper, more advanced stage of leaching, and the B horizon lies about 2 feet beneath the surface.

Bowie fine sandy loam is associated with the Ruston soils and is developed from parent materials of similar characteristics. It occupies somewhat lower topographic positions and has a more nearly flat surface. The A horizon is very similar to that of the Ruston soils, but the B horizon is characterized by a yellow instead of a red color in the upper part and by slight red and gray mottlings in the lower part, although the material contains considerable fine sand and structurally is equally crumbly and permeable as the Ruston soil. The Bowie soil indicates less complete oxidation than the Ruston soil, owing probably to slightly more restricted drainage and aeration.

Caddo fine sandy loam occupies still lower and more nearly flat situations than the Bowie soil. The A horizons are very similar in color and texture to those of the Ruston and Bowie soils, but layer 2 is somewhat paler and the yellow color not so well developed. The material in this layer grades into friable permeable fine sandy clay which is yellow but shows a mottling of gray, the gray color increasing with depth. Although the parent material beneath the Caddo soil is sandy and permeable, the nearly flat relief causes very slow drainage which is reflected in the poorly developed coloration.

Orangeburg fine sandy loam, a distinctive soil of slight extent in this county, occupies smooth areas and has good surface drainage and underdrainage, although the subsoil is heavier and is less freely drained than the subsoil of the Ruston soils. The layers of the A horizon are very similar to those of the Ruston soils and of about equal thickness, but the B horizon is deep red and represents a completely oxidized crumbly friable moderately heavy sandy clay.

On smooth nearly flat terraces made up of old stream-laid sediments are small areas of soils which have developed the same characteristics of the soil layers as those soils occurring on the higher, more rolling uplands, where the soils have developed from older parent material. These are Orangeburg fine sandy loam, Cahaba fine sandy loam which is very similar to Ruston fine sandy loam, and Kalmia fine sandy loam which is much like Caddo fine sandy loam. These soils of the terraces, doubtless developed from ancient alluvium and composed of soil material washed from the local upland soils, well illustrate the character of the regional environmental factors of soil development. They have the same relationships to drainage and oxidation in the layers shown in their profile as the upland soils. They have the same texture and profile arrangement, similar native vegetation, and are suited to the same general crops, with approximately the same productive capacity as the higher lying soils of the upland areas, that have been developed from the older geological formations.

One important soil of the light-colored crumbly subsoil group has freer surface drainage and less rapid underdrainage than Ruston fine sandy loam. This is Kirvin fine sandy loam. It has the same general soil profile arrangement and the same character of the A horizon layers as the Ruston soil, but the B horizon contains more clay than the other soils of this group. Kirvin fine sandy loam has a red heavy subsoil—the B horizon—which is slightly mottled with gray in the lower part and is underlain by parent materials that contain more clay than occurs beneath the soils of the Ruston group. Areas of Kirvin fine sandy loam are rolling, and some slopes are fairly steep. In such places the B horizon is thin. The character of the B horizon in general denotes good oxidation and aeration, as produced by free surface drainage, and lower or less oxidation in the lower part of the subsoil, which is sufficiently heavy to retard underdrainage.

In the vicinity of Douglassville and in the northwestern part of the county, Kirvin fine sandy loam occurs in large areas having a rolling surface with some rather steep slopes. Here the B horizon generally contains a little more sand, is more crumbly, and has freer underdrainage. It is slightly lighter in texture, more freely permea-

ble, and has a dull brownish-red color. In texture and structure it is similar to Orangeburg fine sandy loam. The B horizon is rather free of the thin flat ironstone layer which occurs in broken form in the B horizon in much of Kirvin fine sandy loam in other sections.

A group of these light-colored soils, representing an extreme condition of leaching, includes Ruston fine sand, Norfolk fine sand, and Kalmia fine sand. These soils differ from the soils mentioned, in that the B horizon consists almost entirely of fine sand from which nearly all clay and silt particles have been removed by percolating water.

The group of light-colored soils with dense subsoils is represented by Susquehanna fine sandy loam, Leaf very fine sandy loam, and Lufkin very fine sandy loam. The topsoils are similar to those of the light-colored soils with friable subsoils, but they overlie dense, almost impervious B horizons which are imposed on rather heavy dense clay parent material. Susquehanna fine sandy loam has fairly slow surface drainage, as it is rather smooth, and the subsoil is characterized by mottled gray and red colors, the gray increasing with depth. Leaf very fine sandy loam is an old stream-terrace prototype of the Susquehanna soil. Lufkin very fine sandy loam occupies very low depressed areas without surface drainage, and it is underlain by dense gray clay which shows little effect of aeration and oxidation.

The soils of the alluvial bottom lands are simply deep beds of soil material washed from the upland soils, and they retain the color characteristics as well as the textural qualities of those soils but have no other features that would indicate their origin. These soils are subject to overflow, and fresh sedimentation is added from time to time. They have no developed soil characteristics. Johnston clay is a very dark soil composed of materials that have been washed from areas of the Wilson and Houston soils of the blackland prairies which lie some distance west of this county. The Ochlockonee and Bibb soils are light colored and are made up of soil material washed from light-colored upland soils locally drained by the small streams originating within the county. The Johnston and Bibb soils are very poorly drained and in many places are semiswampy. Ochlockonee fine sandy loam is very similar to the Bibb soil in character, but it is slightly better drained, is darker, has slightly better aeration, and has more developed coloration throughout the upper part.

In table 5 are given the pH determinations of two soils. These determinations were made in the laboratories of the Bureau of Chemistry and Soils, by the hydrogen-electrode method.

TABLE 5.—*pH determinations of two soils from Cass County, Tex.*

Soil type and sample no.	Depth	pH	Soil type and sample no.	Depth	pH
Johnston clay:	*Inches*		Nacogdoches fine sandy loam:	*Inches*	
448801	0–7	6.7	448826	0–10	7.6
448802	7–30	6.7	448827	10–40	6.1
448803	30–60+	6.5	448828	40–60+	6.2

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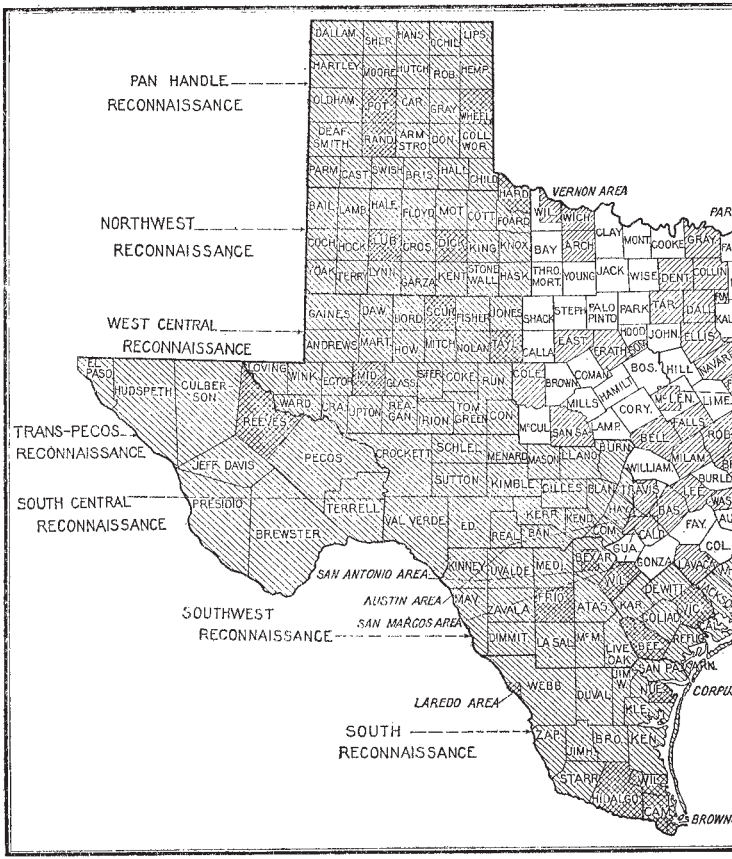
There shall be printed, as soon as the manuscript can be prepared with the necessary maps and illustrations to accompany it, a report on each soil area surveyed by the Bureau of Chemistry and Soils, Department of Agriculture, in the form of advance sheets bound in paper covers, of which not more than two hundred and fifty copies shall be for the use of each Senator from the State and not more than one thousand copies for the use of each Representative for the congressional district or districts in which a survey is made, the actual number to be determined on inquiry by the Secretary of Agriculture made to the aforesaid Senators and Representatives, and as many copies for the use of the Department of Agriculture as in the judgment of the Secretary of Agriculture are deemed necessary.



Areas surveyed in Texas, shown by shading. Detailed surveys shown by nor
reconnaissance surveys shown by northwest-southeast hatching; crosshatch
in both ways.

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BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
SOIL SURVEY DIVISION, CHARLES E. KELLOGG, CHIEF

SOIL MAP
CASS COUNTY
TEXAS

TEXAS AGRICULTURAL EXPERIMENT STATION
A. B. CONNER, DIRECTOR

LEGEND

Bibb fine sandy loam — Bs	Lufkin very fine sandy loam — Lf
Bowie fine sandy loam — Bf	Nacogdoches fine sandy loam — Ni
Caddo fine sandy loam — Cf	Norfolk fine sand — Ns
Cahaba fine sandy loam — Ca	Ochlockonee fine sandy loam — Oy
Johnston clay — Jc	Orangeburg fine sandy loam — Og
Kalmia fine sand — Ka	Ruston fine sand — Ru
Kalmia fine sandy loam — Km	Ruston fine sandy loam — Rf
Kirvin fine sandy loam — Kf; Deep phase — Kf	Susquehanna fine sandy loam — Sl
Stony phase — Kf	Leaf very fine sandy loam — Lv
	Rough stony land — Rs

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
Secondary roads and Trails
Railroads, Steam and Electric
Bridges, Ferry
R.R. crossings, Tunnel
Ford, Dam
School or Church, Cemeteries
Mine or Quarry, Mine dumps, Made land
Bluff, Escarpment, Rock outcrop and Triangulation station
Stony and Gravelly areas
Soil boundaries
State Boundary lines
County Boundary lines
Land Grant, City or Village Boundary lines
Civil Township, Reservation Boundary lines
U.S. township and section lines

RELIEF
(Printed in brown or black)

Contours, Depression contours
Prominent Hills, Mountain Peaks
Sand Wash and Sand dunes
Shore and Low water line, Sandbar

DRAINAGE
(Printed in blue)

Streams
Lakes, Ponds, Intermittent lakes
Intermittent streams
Springs, Canals and Ditches, Flumes
Swamp, Salt marshes
Submerged marsh, Tidal flats

The above signs are in current use on the soil survey maps; those in the margin represent the series on earlier issues.

William T. Carter, Inspector, District 4.
Soils surveyed by M. W. Beck, in charge, and Howard Wm. Higbee, U. S. Department of Agriculture, and R. M. Marshall, Texas Agricultural Experiment Station.

Scale 1 inch = 1 mile
1 0 1 2 3 4 Miles

Field Operations
Bureau of Chemistry and Soils
1933